

U. S. Environmental Protection Agency
Environmental Research Laboratory
Narragansett, R. I.

AUG 21

REGION I
OFFICE OF REGIONAL COUNSEL

Date: August 21, 1986

Subject: Preliminary chemistry results from New Bedford Harbor studies.

From: David Hansen via Walter Berry WJB

To: Charles Bering.

Attached is a summary of all the chemistry data for New Bedford Harbor which we have generated to date.

The data in this report came from 3 different sets of samples: 1) single preliminary core samples from 13 sites in New Bedford Harbor, 2) triplicate analyses of sediment from the 6 sites which we used in our toxicity testing (plus the reference sediment which we used), and 3) tissue and egg samples from fish exposed to those sediments. Analyses were performed in three ways: 1) selected metals were measured using flame atomic absorption, 2) PCBs were measured as Aroclor 1254 by electron capture gas chromatography, 3) PCBs were also measured as chlorine number congeners and total PCBs by gas chromatography/mass spectrometry (according to the procedures of EPA EMSL, Cincinnati). Draft chemical procedures are available upon request. The values from the triplicate samples are presented both as individual values (tables 2 and 4) and as means (tables 3 and 5).

The GC-MS data from the triplicate analyses are also presented in two different graphical formats. Figs 2-7 are bar graphs showing PCB composition by chlorine number congener of the sediments from each station. The composition, by chlorine number congener, of 7 reference Aroclor mixtures (e.g. Aroclor 1254) are included for comparison (figs. 8-14). Finally, total PCB and PCB broken down into chlorine number congeners are plotted vs. station number (figs. 15-25). Higher station numbers generally correspond to a greater distance upstream from the hurricane barrier (see fig. 1).

We have also included a proposal for some PAH work. In addition we are planning to do chlorine number congener analysis on tissue samples which have already been analyzed for Aroclor 1254 and selected metals.

TABLE 1. - Concentration (ug/g dry weight) of polychlorinated biphenyls (Aroclor 1254) and selected metals in sediments collected from New Bedford Harbor on January 21 and 22, 1986. Samples analyzed were composites of cores from 9 to 13 ponar dredge samples from Stations 2 to 14; one dredge sample was analyzed from Station 1.

STATION	Aroclor 1254	Cd	Cu	Cr	Fe	Mn	Ni	Pb	Zn	Wet + Dry weight
1	2.64	1.75	113	56.6	7,020	71.5	7.58	54.9	122	1.72
2	3.88	4.06	368	178	11,600	98.8	18.5	124	264	2.00
3	5.06	3.77	466	213	16,600	135	22.5	150	332	2.53
4	5.45	4.32	648	343	17,100	141	24.1	174	331	2.34
5	3.76	4.42	441	177	15,700	122	27.3	153	392	2.22
6	13.9	10.3	1,520	753	18,400	134	46.1	294	655	2.55
7	11.1	5.82	892	421	22,600	165	39.3	251	522	3.59
8	19.3	6.07	1,800	944	22,300	164	35.8	524	485	2.63
9	14.3	8.00	1,490	768	14,300	103	32.6	259	562	2.21
10	13.6	7.93	934	465	14,400	110	50.5	235	577	2.27
12	151	78.4	2,540	1,700	19,400	139	214	617	2,150	2.57
13	306	69.6	1,480	1,120	17,400	158	142	731	2,420	2.90
14	540	46.8	1,180	710	16,900	156	142	882	2,530	2.85

TABLE 2. - Concentration (ug/g dry weight) of polychlorinated biphenyls (Aroclor 1254) and selected metals in sediments from New Bedford Harbor. Values are from triplicate samples from one composite from 9 to 13 ponar dredge samples from each station in New Bedford Harbor that have been tested for their toxicity.

STATION	Aroclor 1254	Cd	Cu	Cr	Fe	Mn	Ni	Ph	Zn	Wet weight	Dry weight	Organic carbon, %
South Reference*	0.0581	0.155	54.6	47.2	17,100	383	20.0	48.5	134	2.23		
	0.0480	0.189	56.5	49.3	18,200	373	20.6	47.2	140	2.35		
	0.0480	0.099	50.0	44.6	16,200	346	18.9	43.0	124	2.11		
NBH-5	6.95	3.98	401	174	13,900	106	28.3	141	337	2.38		
	7.05	4.35	418	189	14,600	116	30.4	149	349	2.48		
	7.92	4.21	426	192	14,800	115	30.3	149	361	2.48		
NBH-7	12.3	5.73	882	411	21,900	162	39.7	268	546	3.60		
	12.7	5.90	911	416	22,000	162	41.6	274	563	3.64		
	14.9	5.67	882	405	21,500	159	38.8	268	539	3.56		
NBH-6	19.6	10.4	1,570	730	19,700	140	47.9	311	707	2.82		
	18.6	10.2	1,540	709	19,500	139	48.8	306	684	2.79		
	19.8	9.82	1,420	657	17,900	132	45.0	292	634	2.67		
NBH-8	29.2	5.34	1,640	838	22,700	171	37.5	337	470	2.97		
	32.5	5.35	1,620	834	22,800	172	39.6	324	464	2.92		
	31.2	5.43	1,590	814	22,300	172	37.6	321	458	2.94		
NBH-12	256	92.6	2,920	1,810	25,000	195	268	742	2,790	3.73		
	193	70.6	2,350	1,460	21,900	153	215	596	2,260	3.33		
	245	74.4	2,480	1,530	21,100	160	228	637	2,380	3.19		
NBH-14	913	41.6	1,150	690	18,400	176	143	888	2,330	3.66		
	1,140	40.5	1,120	683	17,600	164	139	843	2,300	3.46		
	1,240	39.4	1,070	637	16,800	156	135	789	2,180	3.30		

* South Reference sediment is from central Long Island Sound (41° 7.95'N and 72° 52.7'W).

TABLE 3 : Concentration (ug/g dry weight) of polychlorinated biphenyls (Aroclor 1254) and selected metals in sediments from New Bedford Harbor. Values are means of triplicate samples from a composite of 9 to 13 Ponar dredge sediment samples from each station in New Bedford Harbor which was used in the fish studies.

STATION	AROCLOR 1254	Cd	Cu	Cr	Fe	Mn	Ni	Pb	Zn
REF*	0.051	0.148	53.7	47.0	17100	367	19.8	46.2	133
NBH-5	7.30	4.18	415	185	14500	112	29.7	147	349
NBH-6	19.3	10.2	1509	699	19027	137	47.3	303	675
NBH-7	13.3	5.76	891	410	21800	161	40.0	270	549
NBH-8	30.9	5.37	1620	829	22600	172	38.2	328	464
NBH-12	231	79.2	2580	1600	22700	170	237	658	2480
NBH-14	1100	40.5	1110	670	17600	165	139	840	2270

* The reference sediment is from Central Long Island Sound.

Table 4. Concentration (ug/g dry weight) of polychlorinated biphenyls (PCBs) in sediments from New Bedford Harbor. Analysis was performed by GC/MS. Concentrations are reported by chlorine number congeners, and as total PCBs. Values are from triplicate samples from one composite from 9 to 13 Ponar dredge samples from each station in New Bedford Harbor that have been tested for their toxicity.

Sample ID	Cl - 1	Cl - 2	Cl - 3	Cl - 4	Cl - 5	Cl - 6	Cl - 7	Cl - 8	Cl - 9	Cl - 10	Σ ug/g
3082 Ref	nd*	nd*	nd*	nd*	nd*	nd*	nd*	nd*	nd*	nd*	nd*
3083 Ref	nd*	nd*	nd*	nd*	nd*	nd*	nd*	nd*	nd*	nd*	nd*
3084 Ref	nd*	nd*	nd*	nd*	0.02	0.02	0.02	0.02	nd*	0.02	0.08
3085 5B	nd*	0.22	1.4	4.0	4.0	2.1	0.20	nd*	nd*	nd*	12
3086 5B	nd*	0.21	1.2	3.4	3.1	1.4	0.08	nd*	nd*	nd*	9.4
3087 5B	nd*	0.21	1.2	3.4	3.2	1.6	0.21	nd*	nd*	nd*	9.7
3088 6B	nd*	0.46	4.1	13	12	5.6	0.67	nd*	nd*	nd*	36
3090 6B	nd*	0.49	3.9	11	10	4.5	0.43	nd*	nd*	nd*	30
3091 6B	nd*	0.50	3.5	9.8	9.8	5.6	0.72	nd*	nd*	nd*	30
3092 7B	nd*	0.15	1.5	5.5	5.8	3.0	0.22	nd*	nd*	nd*	16
3093 7B	nd*	0.08	1.4	5.6	6.2	1.8	nd*	nd*	nd*	nd*	15
3094 7B	nd*	0.38	2.1	6.3	6.8	3.0	0.30	nd*	nd*	nd*	19
3095 8B	nd*	0.60	6.2	17	18	8.2	1.4	nd*	nd*	nd*	51
3096 8B	nd*	0.88	8.0	19	18	7.8	0.55	nd*	nd*	nd*	55
3098 8B	nd*	0.97	8.2	21	21	9.4	1.6	0.06	nd*	nd*	62
3099 12B	nd*	3.5	36	91	62	19	1.8	nd*	nd*	nd*	210
3100 12B	nd*	5.0	35	75	49	17	2.0	nd*	nd*	nd*	180
3101 12B	nd*	8.6	51	110	73	24	3.6	nd*	nd*	nd*	270
3102 14B	7.8	390	830	910	380	110	13	1.3	0.43	nd*	2600
3103 14B	8.9	380	770	790	350	100	11	0.71	0.36	nd*	2400
3104 14B	9.6	440	920	990	410	120	12	0.91	nd*	nd*	2900

*nd = non detectable (As low as 0.02 ug/g, depending on sample dry weight and congener response)

Table 5. Mean concentration (ug/g dry weight) of polychlorinated biphenyls (PCBs) in sediments from New Bedford Harbor. Analysis was performed by GC/MS. Concentrations are reported by chlorine number congeners, and as total PCBs. Values are from triplicate samples (see Table 4) from one composite from 9 to 13 Ponar dredge samples from each station in New Bedford Harbor that have been tested for their toxicity.

Sample ID	Cl - 1	Cl - 2	Cl - 3	Cl - 4	Cl - 5	Cl - 6	Cl - 7	Cl - 8	Cl - 9	Cl - 10	Σ ug/g
Avg Ref	nd*	nd*	nd*	nd*	0.01	0.01	0.01	0.01	nd*	0.01	0.03
Avg 5 B	nd*	0.22	1.2	3.6	3.4	1.7	0.16	nd*	nd*	nd*	10
Avg 6 B	nd*	0.49	3.8	11	11	5.2	0.61	nd*	nd*	nd*	32
Avg 7 B	nd*	0.20	1.7	5.8	6.3	2.6	0.17	nd*	nd*	nd*	17
Avg 8 B	nd*	0.82	7.5	19	19	8.5	1.2	0.02	nd*	nd*	56
Avg 12 B	nd*	5.7	40	93	61	20	2.4	nd*	nd*	nd*	220
Avg 14 B	8.8	410	840	900	380	110	12	0.98	0.26	nd*	2600

*nd = non detectable (As low as 0.02 ug/g, depending on sample dry weight and congener response)

TABLE 6 : Concentration (ug/g dry weight) of polychlorinated biphenyls (Aroclor 1254) and selected metals in sheepshead minnows exposed to sediments from New Bedford Harbor for 29 days. NBH-14 fish were exposed for 11 days because the fish exposed to NBH-14 sediment in the beginning of the exposure period died within 14 days. Values are from single analyses done on composites of 3-9 females (F) or 2-4 males (M).

TREAT	sex	AROCLOR 1254	Cd	Cu	Cr	Fe	Mn	Ni	Pb	Zn
REF-1	F	0.513	0.000	11.0	0.26	30.6	6.66	0.16	0.38	85.2
REF-1	M	0.456	0.000	4.90	0.07	18.4	3.64	0.14	0.00	53.3
REF-2	F	0.634	0.000	9.00	0.17	26.2	5.74	0.31	0.10	75.7
REF-2	M	0.445	0.000	7.00	0.35	19.7	3.88	0.30	0.00	50.3
NBH-5	F	21.0	0.049	12.3	0.61	48.5	3.65	0.48	0.62	85.5
NBH-5	M	15.6	0.017	8.10	0.91	36.2	2.95	0.66	0.29	81.2
NBH-7	F	43.4	0.000	8.40	0.35	45.9	3.20	0.32	0.17	68.5
NBH-7	M	76.5	0.000	9.70	0.76	48.5	3.47	0.45	0.16	72.0
NBH-8	F	59.0	0.000	10.0	0.91	34.7	2.90	0.44	0.56	81.5
NBH-8	M	73.8	0.000	5.00	0.76	21.7	2.34	0.52	0.17	80.1
NBH-12	F	142	0.010	11.5	0.28	38.4	3.49	0.29	0.33	106
NBH-12	M	127	0.000	10.4	2.72	44.3	2.95	2.06	1.03	83.4
NBH-14	F	107	0.000	8.10	0.06	23.8	3.56	0.00	0.00	63.3
NBH-14	M	100	0.000	9.60	0.94	30.3	3.91	0.59	0.06	77.9

* The reference sediment is from Central Long Island Sound.

Table 7. Concentration (ug/g dry weight) of polychlorinated biphenyls (PCBs) in sediments from New Bedford Harbor. Analysis was performed by GC/MS. Concentrations are reported by chlorine number congeners, and as total PCBs. Values are composites of cores from 9 to 13 Ponar dredge samples from stations 2 to 14 in New Bedford Harbor; one dredge sample was analyzed from station 1.

Sample ID	Cl - 1	Cl - 2	Cl - 3	Cl - 4	Cl - 5	Cl - 6	Cl - 7	Cl - 8	Cl - 9	Cl - 10	Σ ug/g
NBH-1	nd*	0.20	0.93	1.9	1.7	0.65	0.02	nd*	nd*	nd*	5.3
NBH-2	nd*	0.20	1.4	3.6	3.0	1.1	0.08	nd*	nd*	nd*	9.4
NBH-3	nd*	0.18	1.4	3.9	4.0	1.6	0.10	nd*	nd*	nd*	11
NBH-4	nd*	0.15	1.0	2.9	2.7	1.2	0.08	nd*	nd*	nd*	8.0
NBH-5	nd*	0.08	0.73	2.2	2.3	0.87	0.02	nd*	nd*	nd*	6.1
NBH-6	nd*	0.30	2.9	7.8	7.1	2.7	0.17	nd*	nd*	nd*	21
NBH-7	nd*	0.21	1.7	6.1	6.8	2.6	0.19	nd*	nd*	nd*	18
NBH-8	nd*	0.55	5.9	15	17	7.5	0.67	nd*	nd*	nd*	47
NBH-9	nd*	0.39	4.0	11	12	4.5	0.37	nd*	nd*	nd*	32
NBH-10	nd*	0.36	4.1	12	10	3.9	0.27	nd*	nd*	nd*	30
NBH-12	nd*	5.6	57	120	81	20	nd*	nd*	nd*	nd*	280
NBH-13	nd*	65	250	300	150	33	nd*	nd*	nd*	nd*	790
NBH-14	3.7	270	650	680	310	66	nd*	nd*	nd*	nd*	2000

*nd = non detectable (As low as 0.02 ug/g, depending on sample dry weight and congener response)

TABLE 8: Concentration (ug/g dry weight) of polychlorinated biphenyls (Aroclor 1254) in eggs from sheepshead minnows exposed to sediments from New Bedford Harbor (See Table 6). Values are the means of analyses done on eggs from individual females.

TREATMENT	N	Aroclor 1254	S. D.
REF-1	2	143	21
REF-2	4	147	52
NBH-5	4	8960	5120
NBH-7	5	20100	3970
NBH-8	6	28900	9600
NBH-12	6	78500	36500
NBH-14	6	67200	20400

* Aroclor 1254 was n. d. in 4 samples.

** Aroclor 1254 was n. d. in 2 samples.

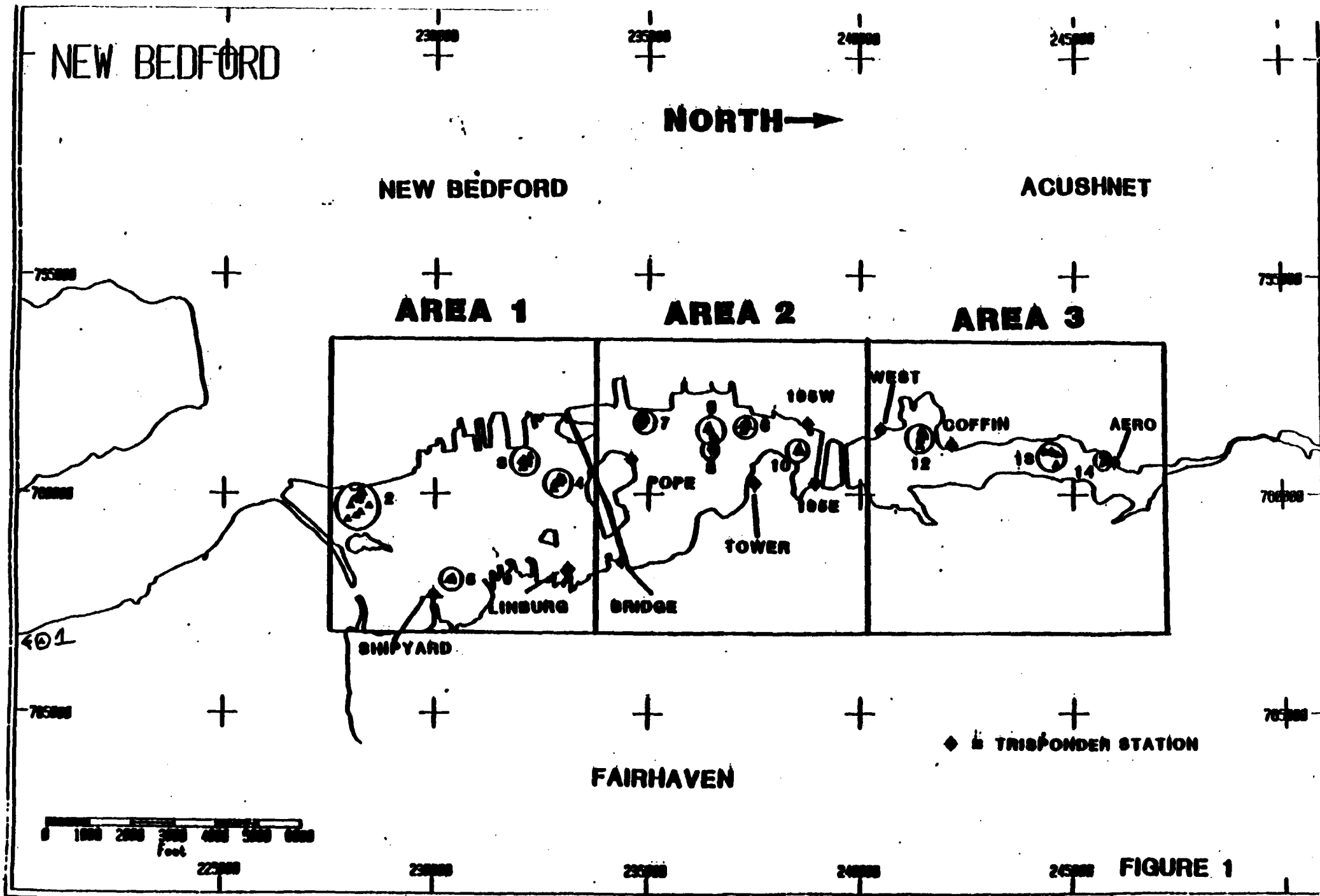


FIGURE 1: Stations in New Bedford Harbor from which sediments were collected on January 21 and 22, 1986. Each triangle represents one of the 9 to 13 Ponar grab samples collected at each station. Station 1 was outside of the Hurricane Barrier, off of Cornell-Dublier Electronics.

Station 5B, reps A,B,C

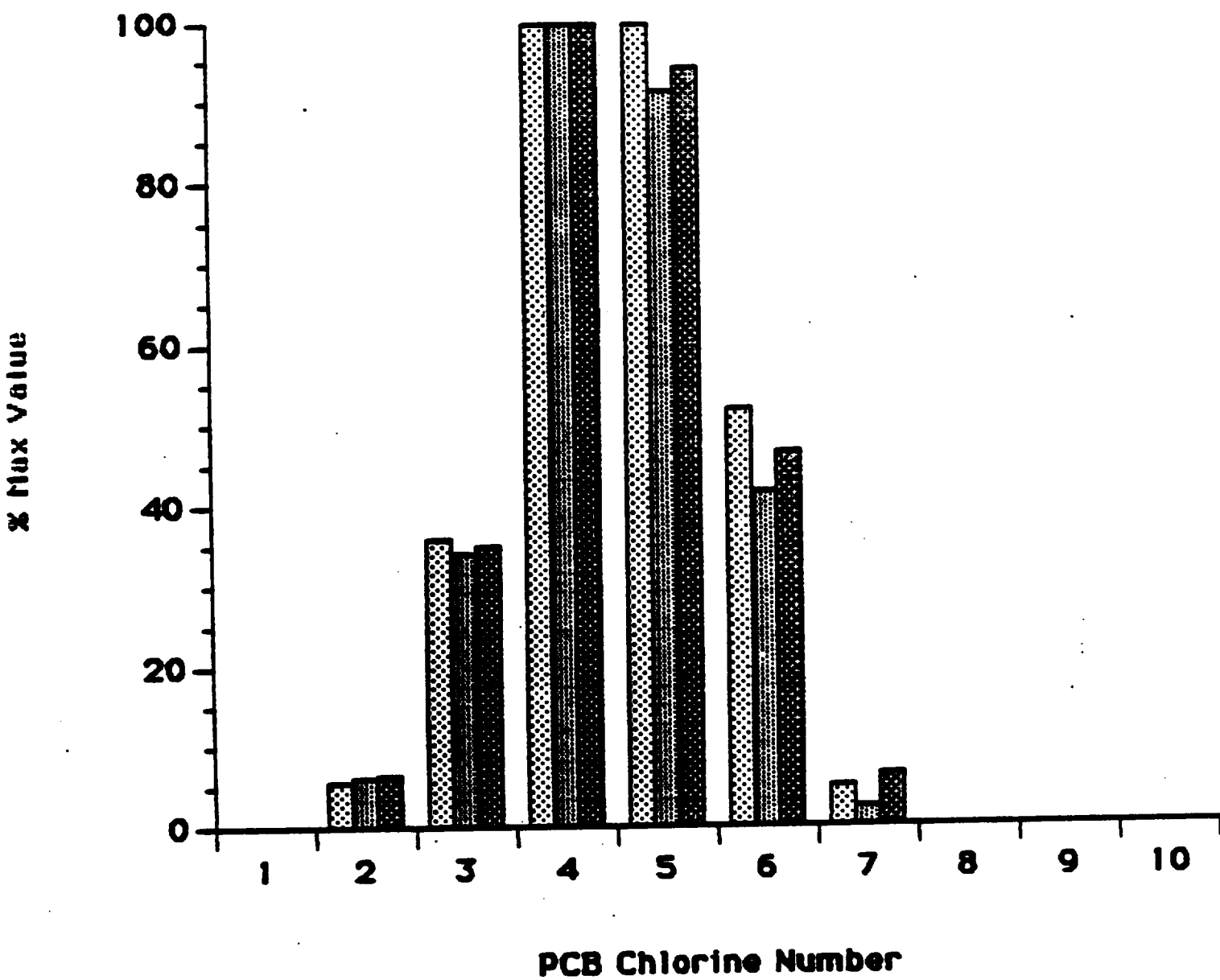


Figure 2

Station 6B reps A,B,C

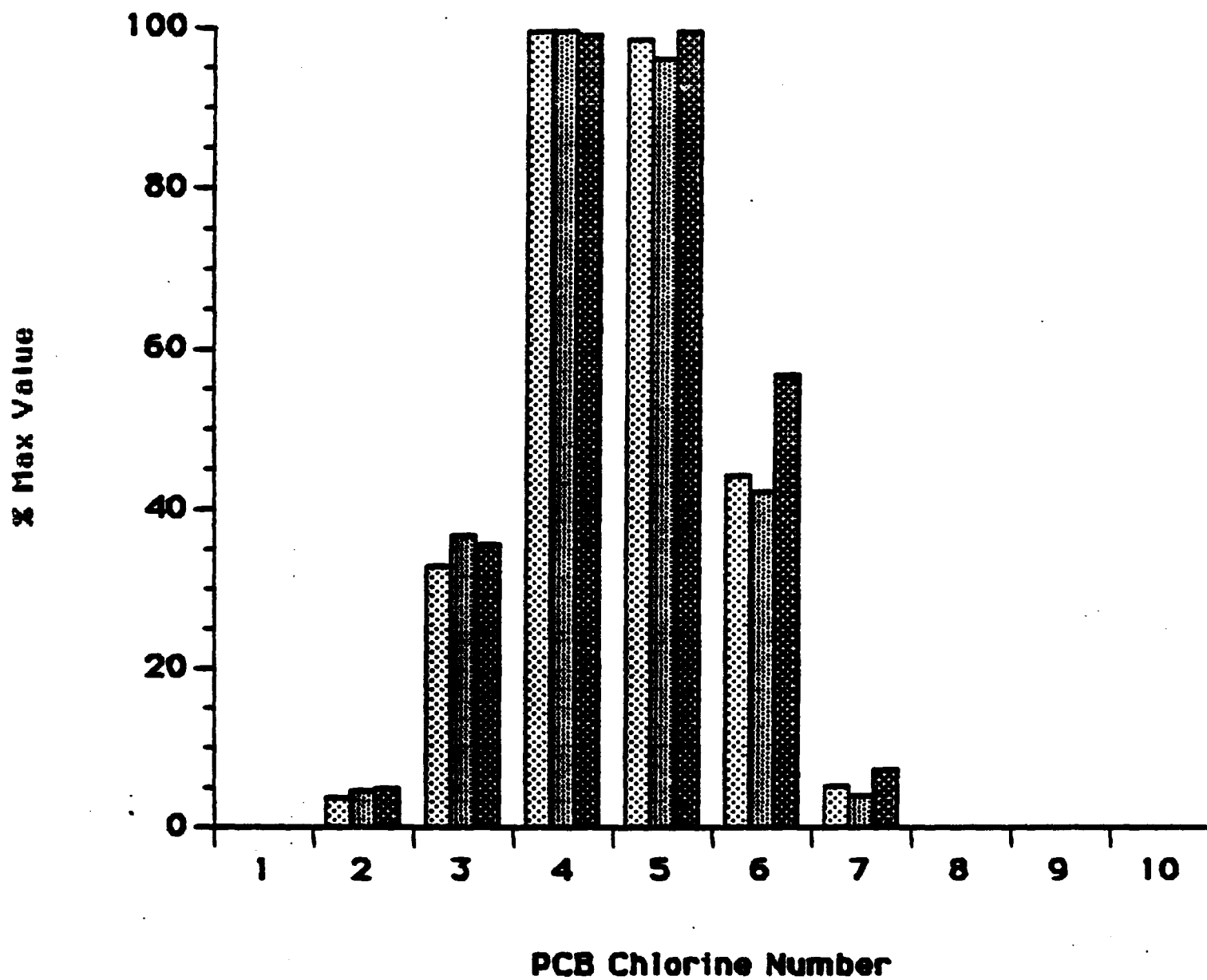


Figure 3

Station 7B reps A,B,C

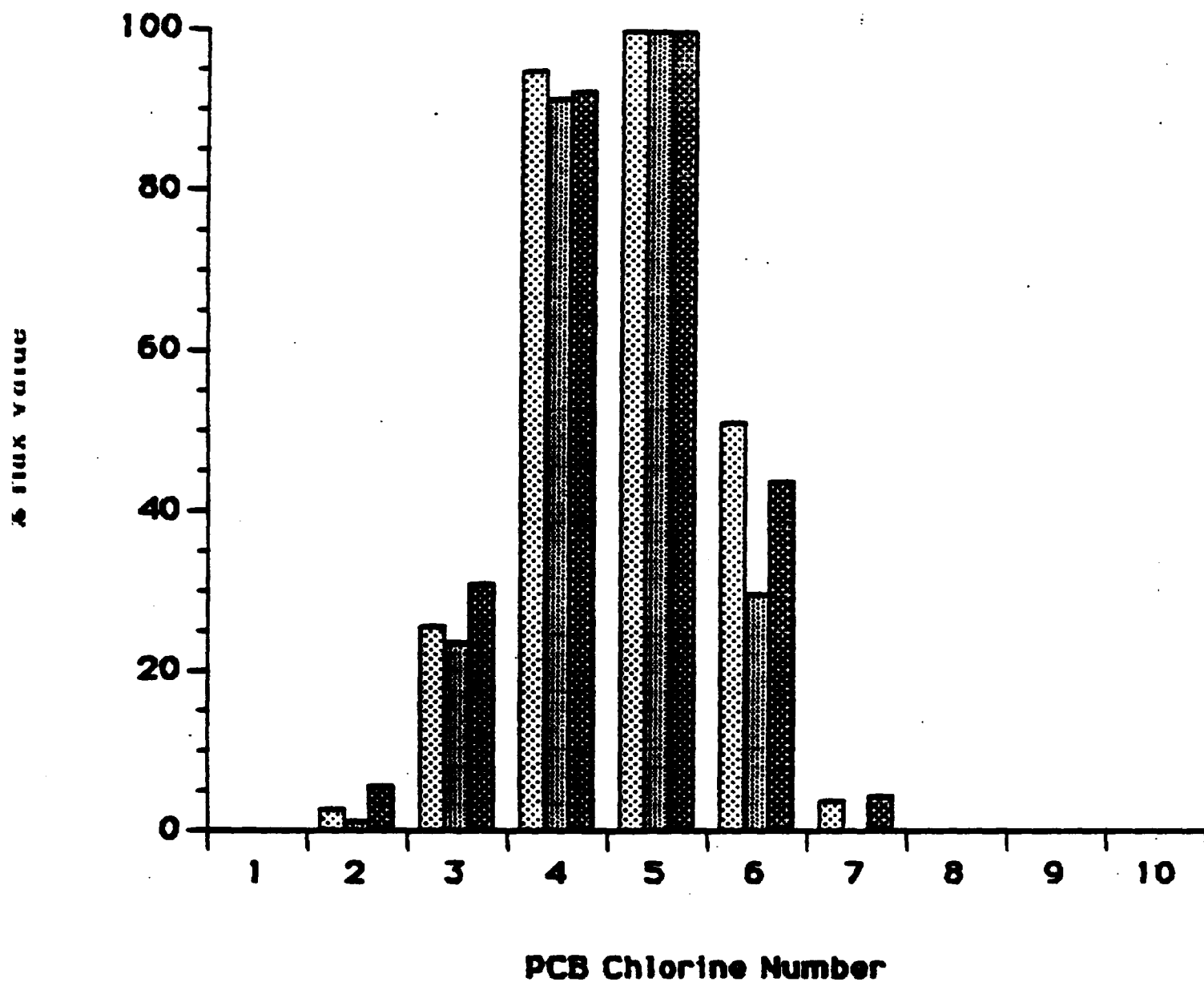


Figure 4

Station 8B reps A,B,C

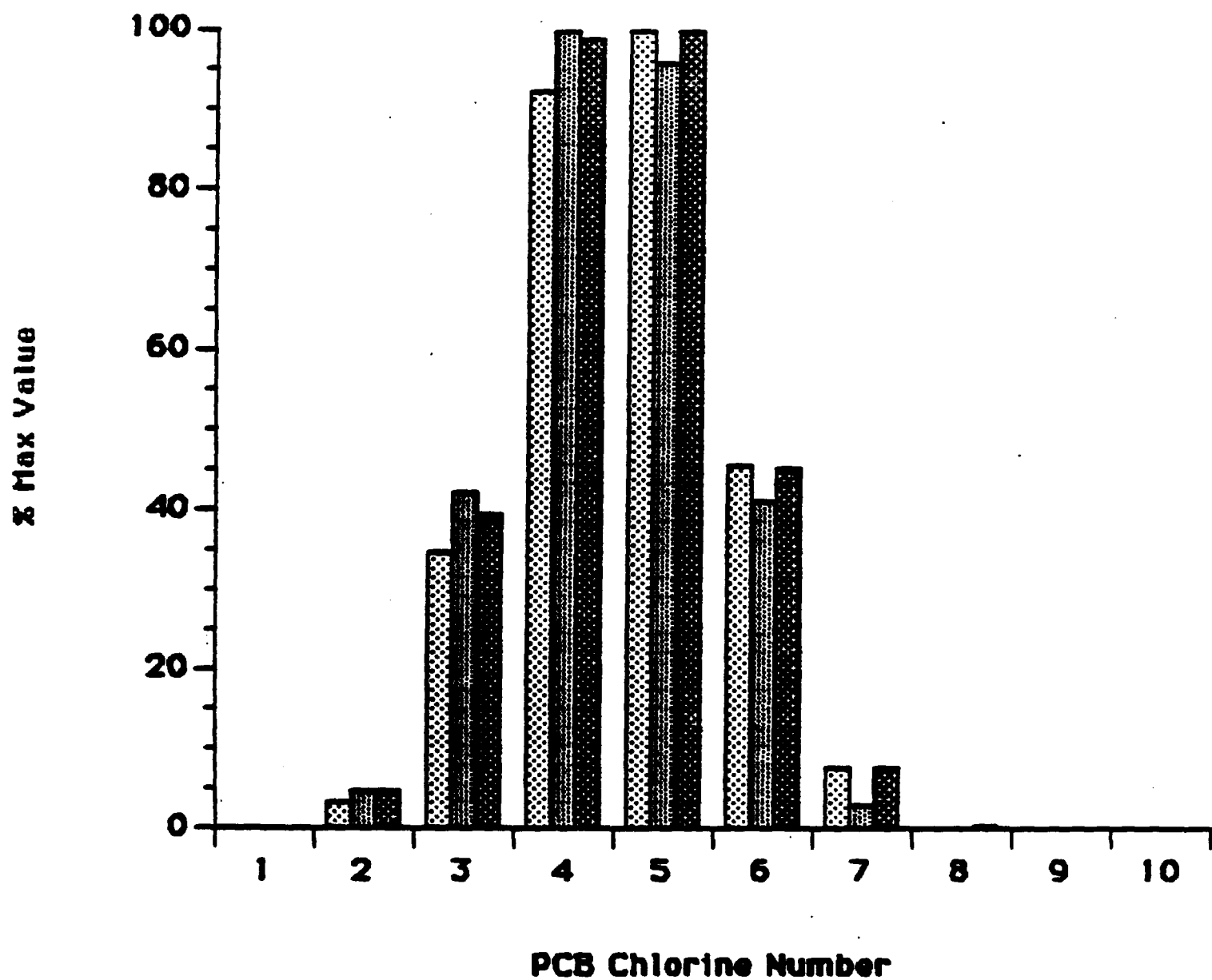


Figure 5

Station 12B reps A, B, C

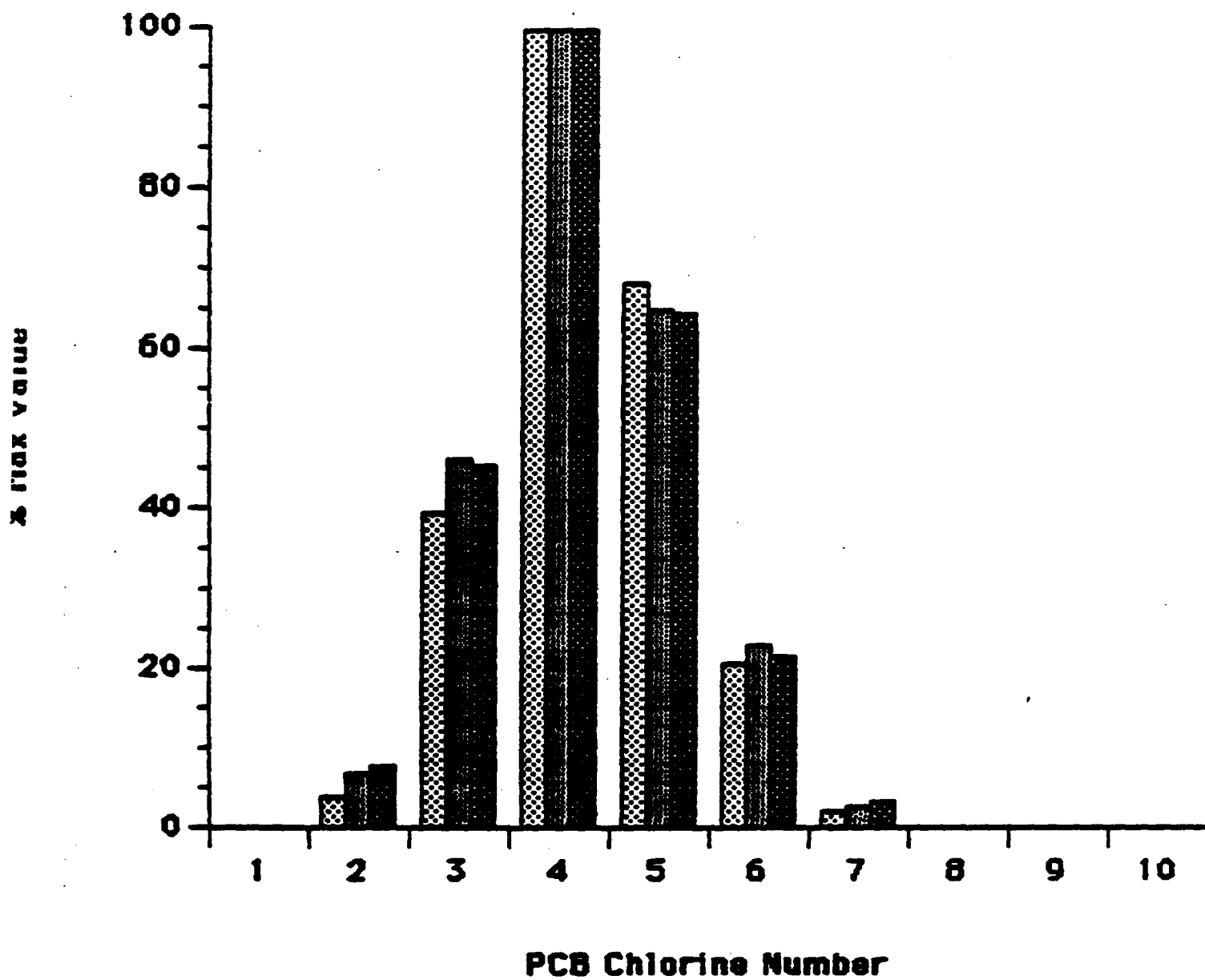


Figure 6

Station 14B Reps A, B, C

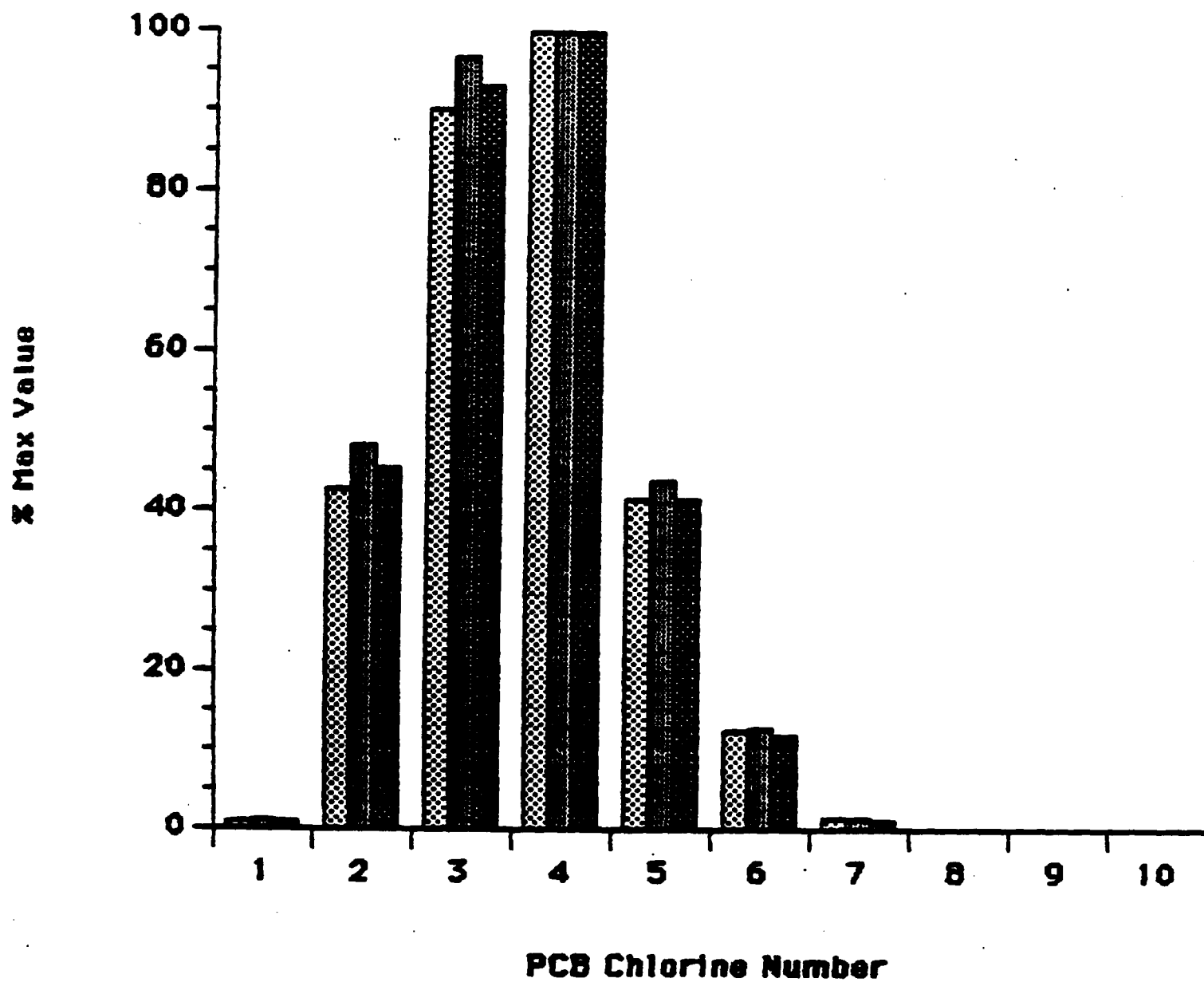


Figure 7

Aroclor 1016

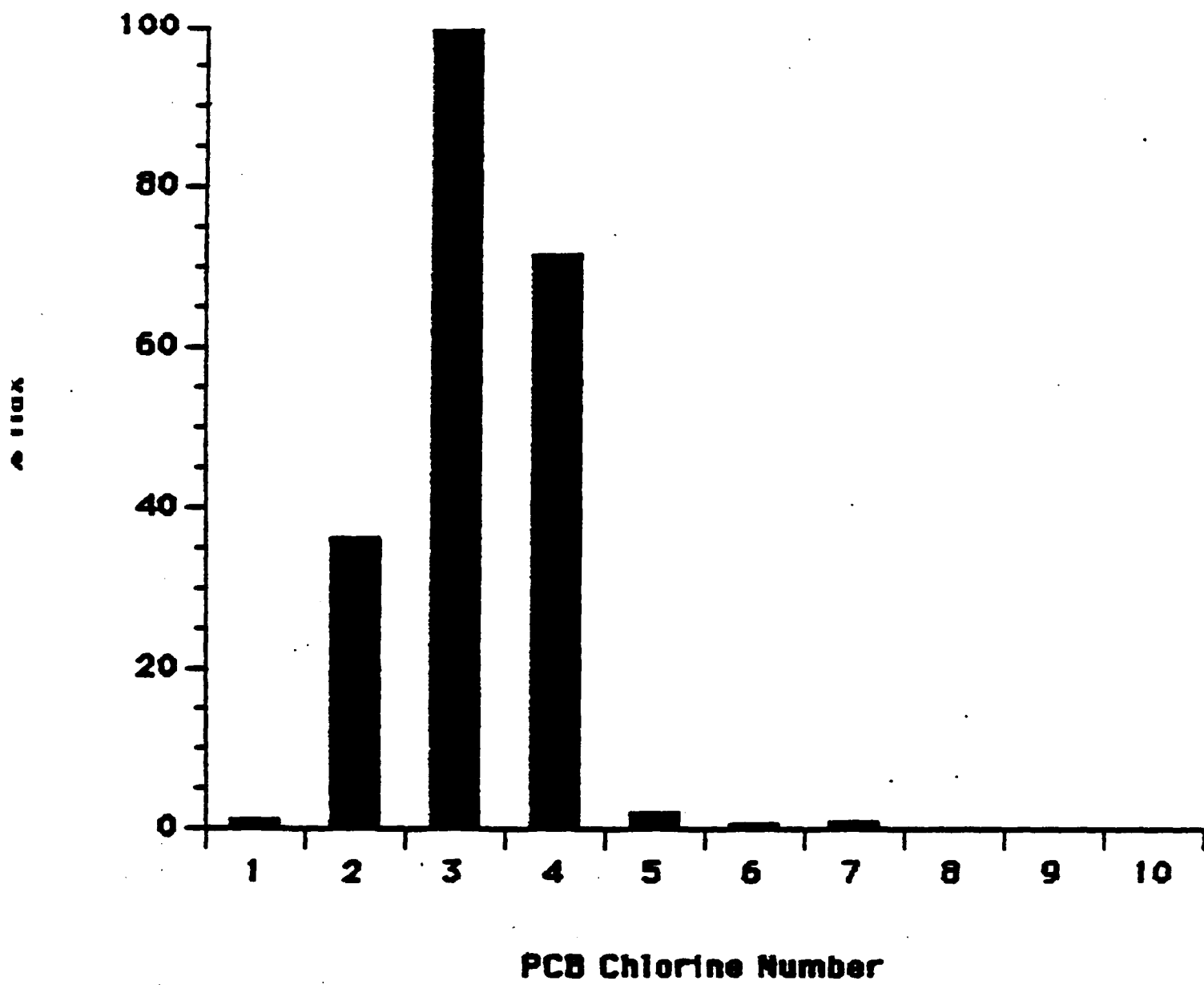


Figure 8

Aroclor 1221

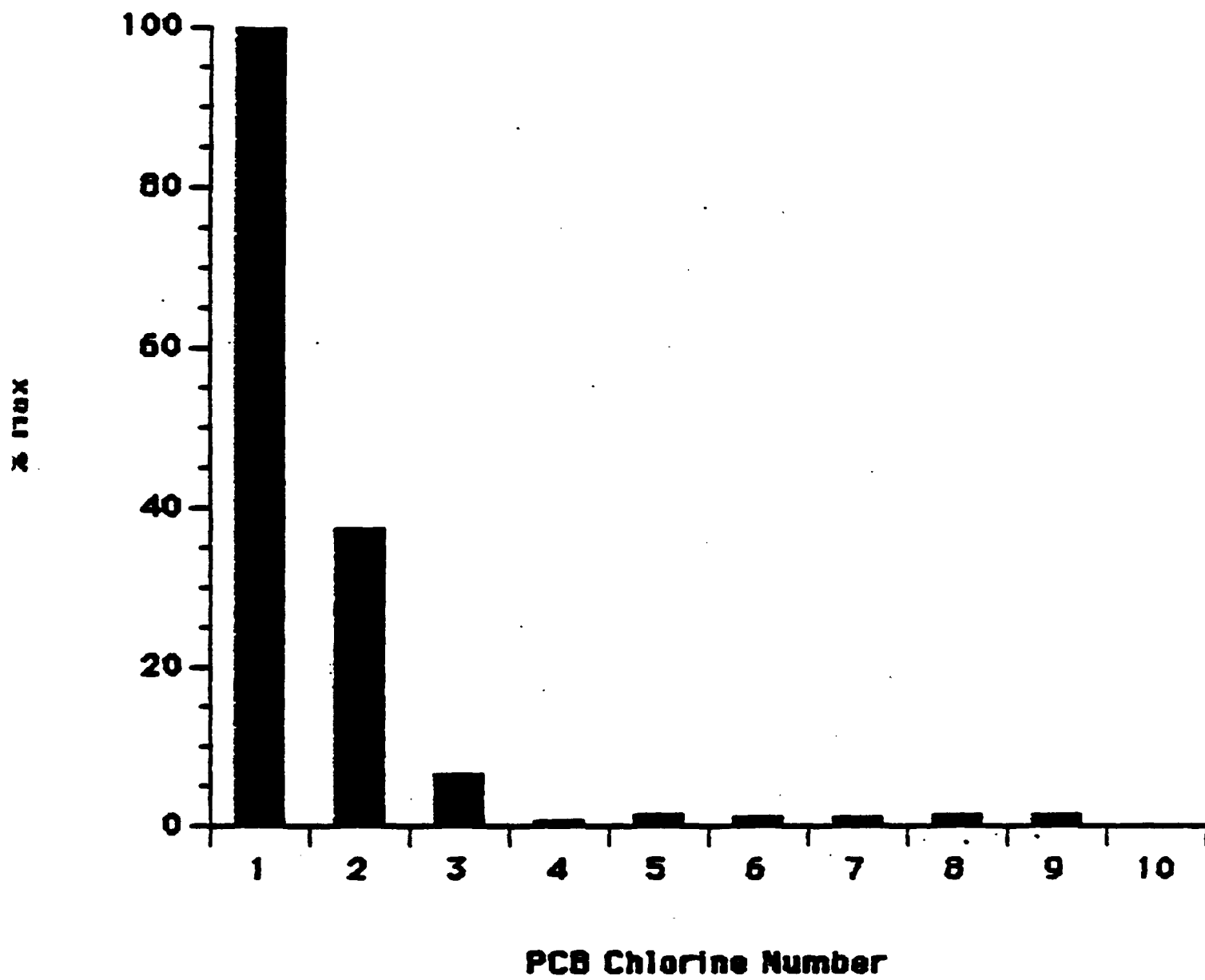
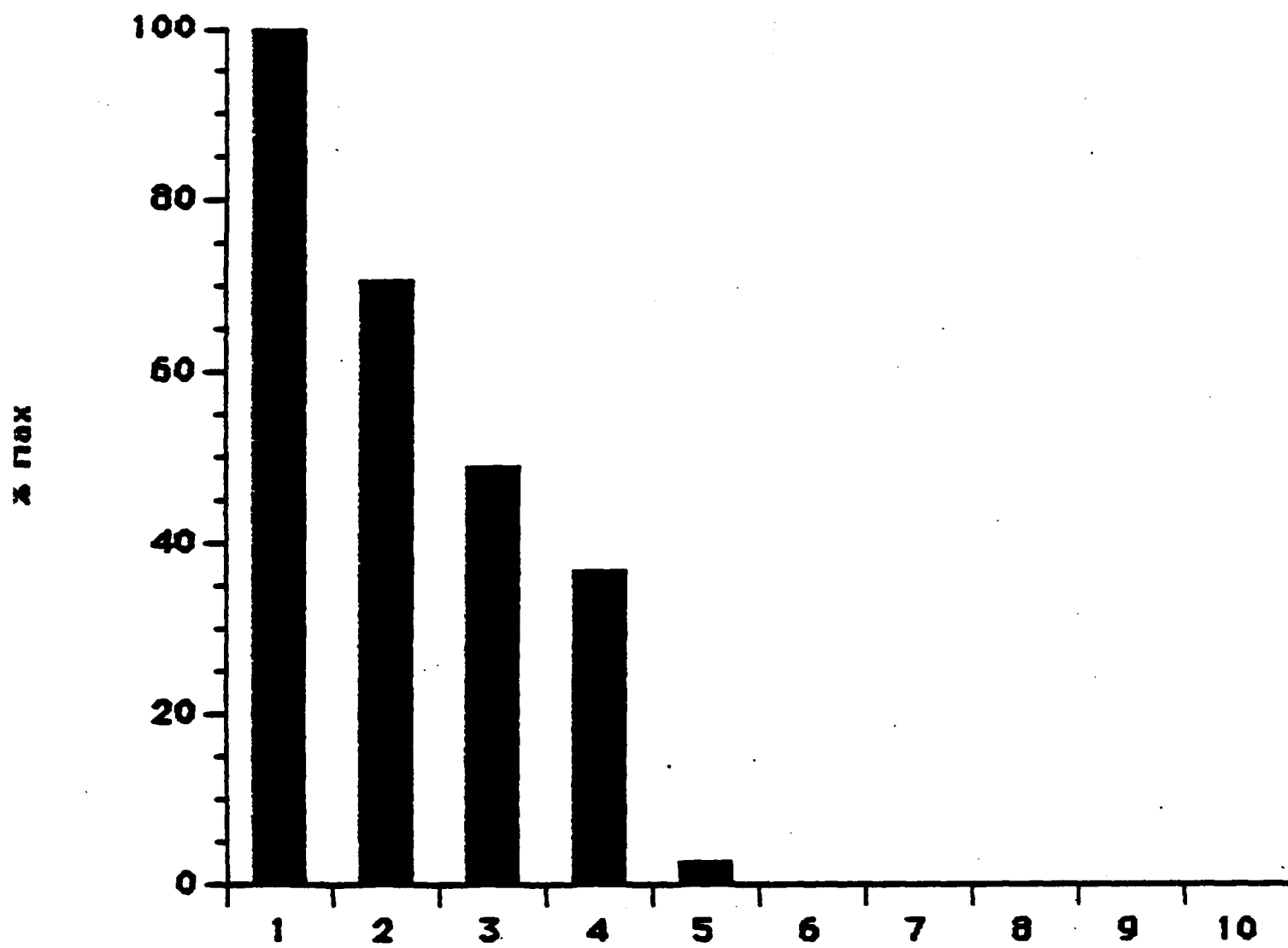


Figure 9

Arochlor 1232



PCB Chlorine Number

Figure 10

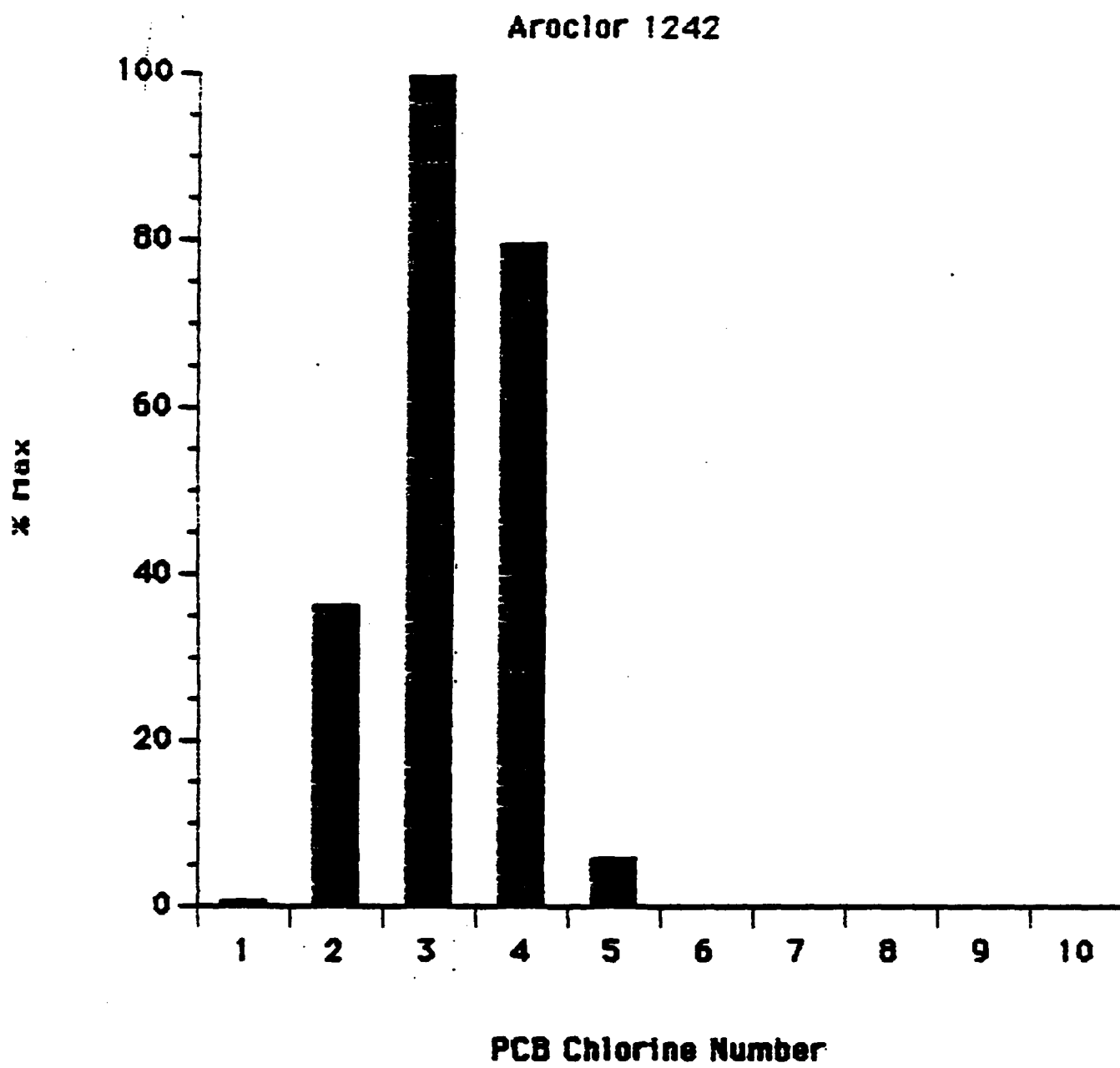


Figure 11

Aroclor 1248

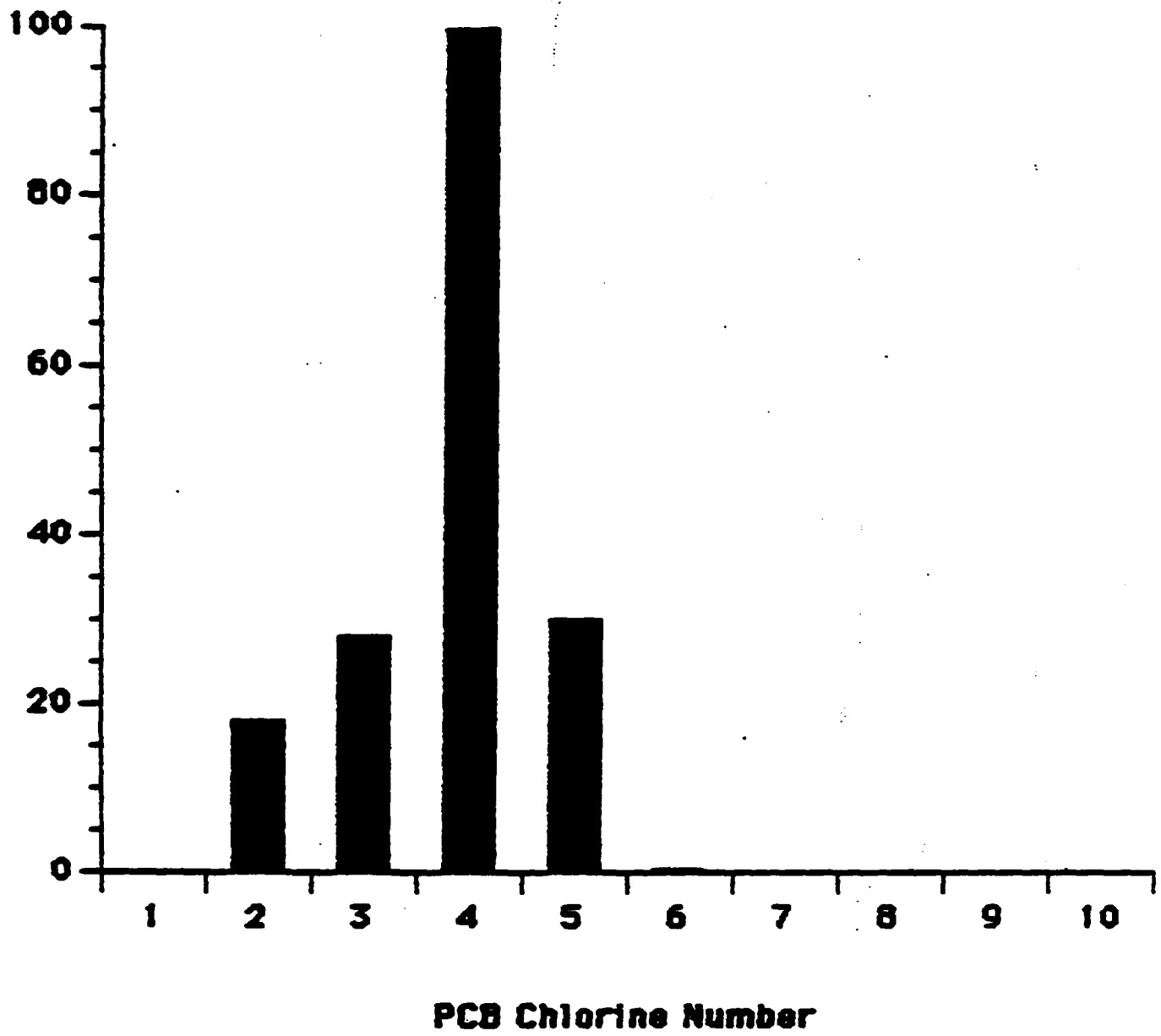


Figure 12

Aroclor 1254

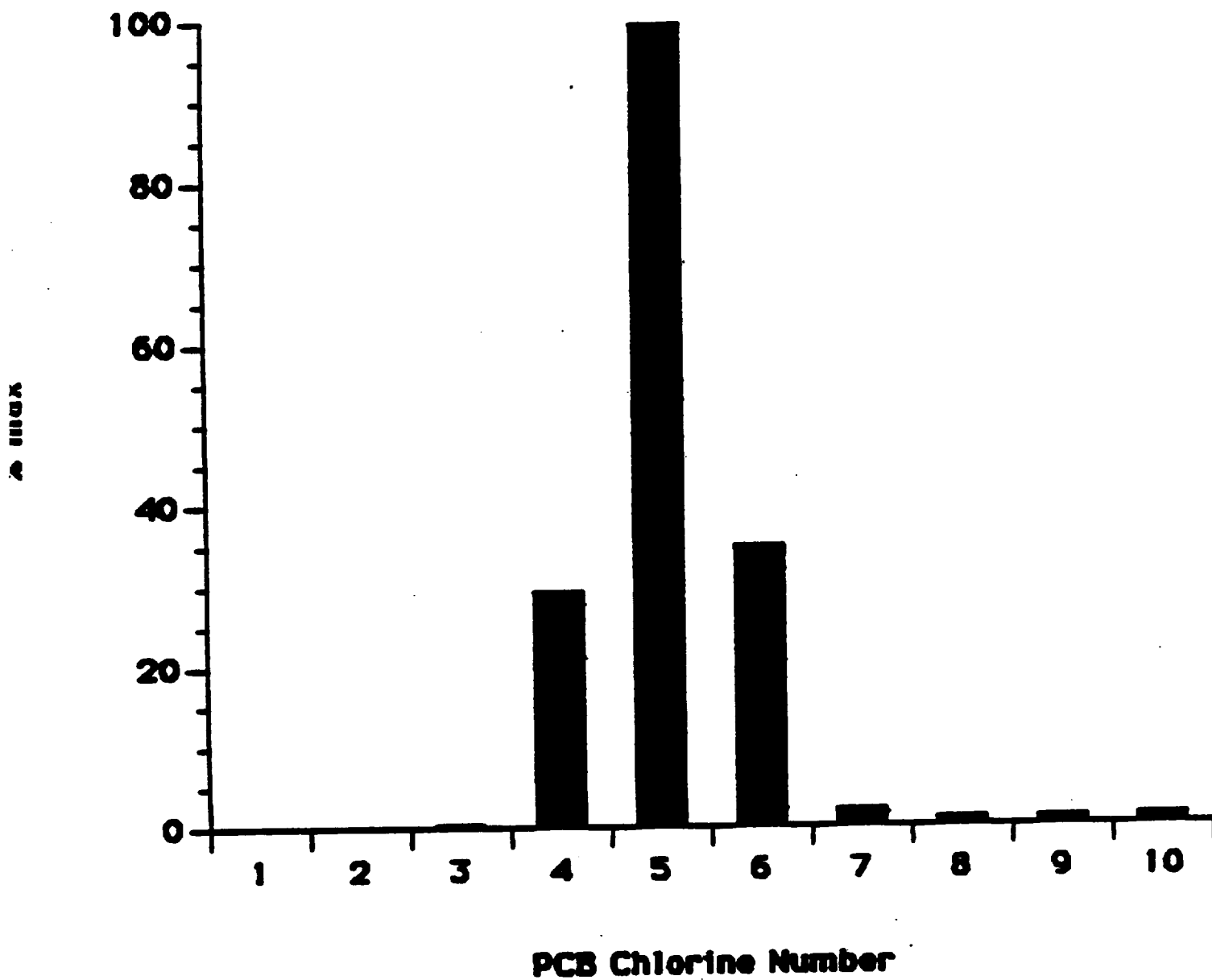


Figure 13

Aroclor 1260

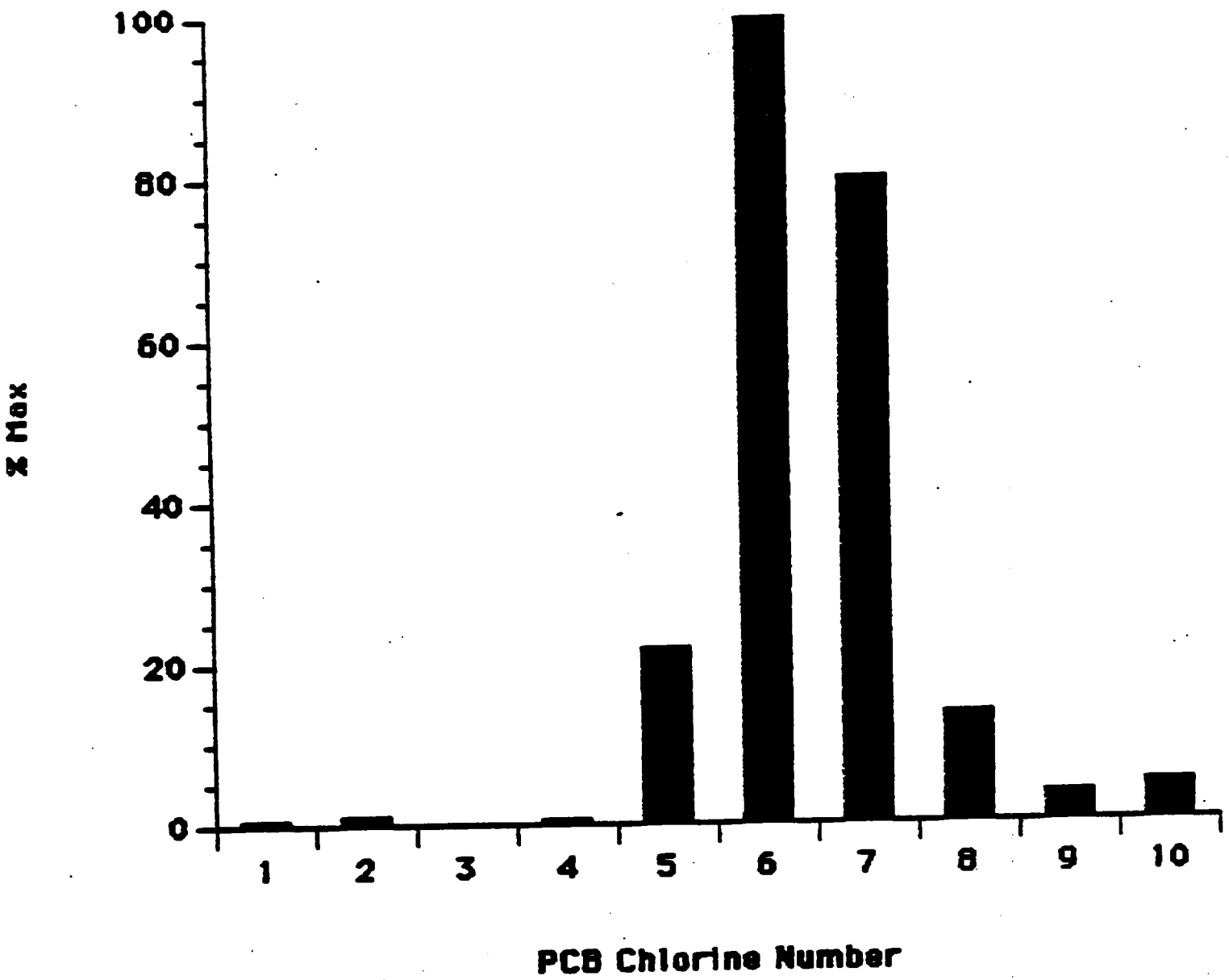


Figure 14

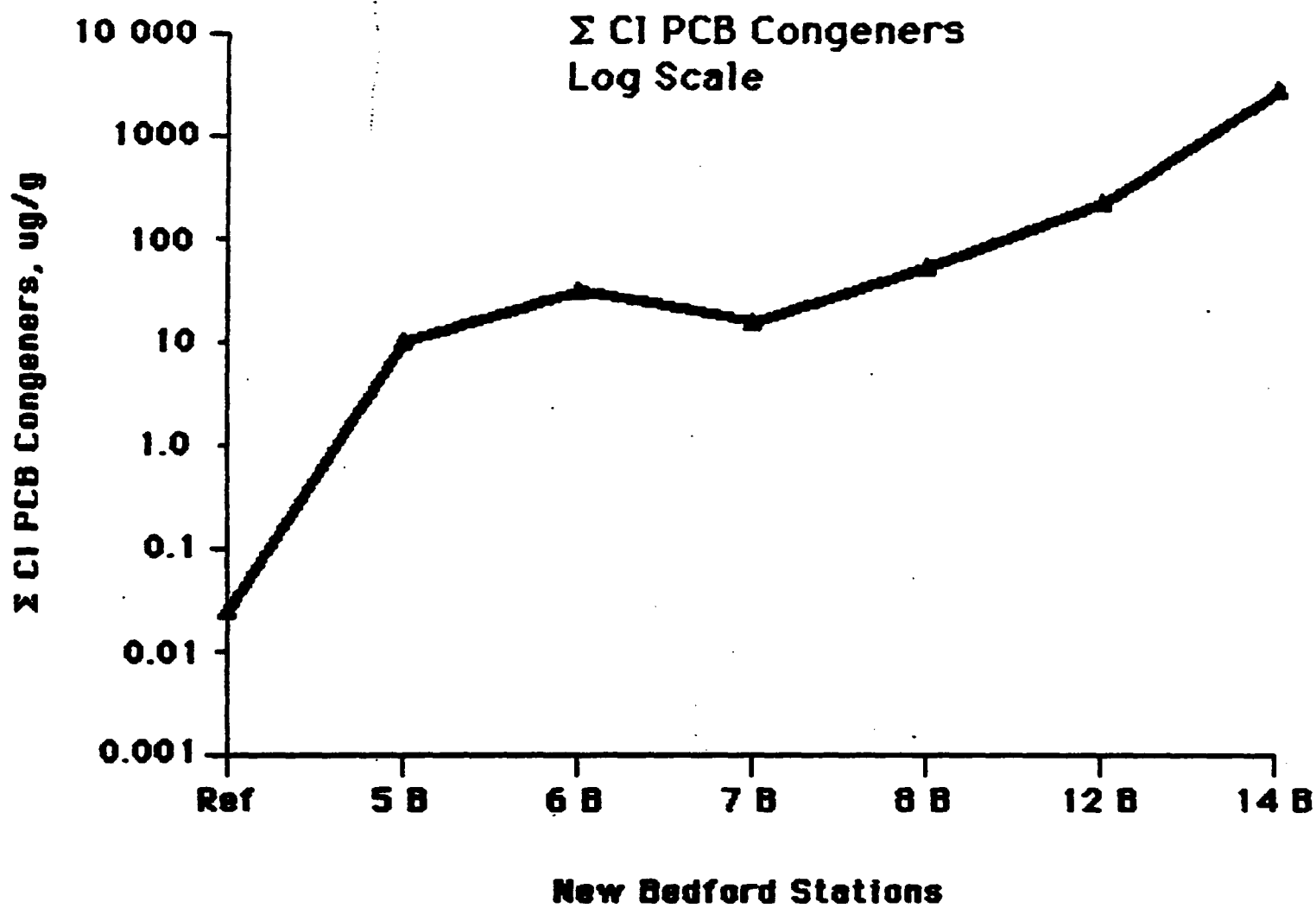


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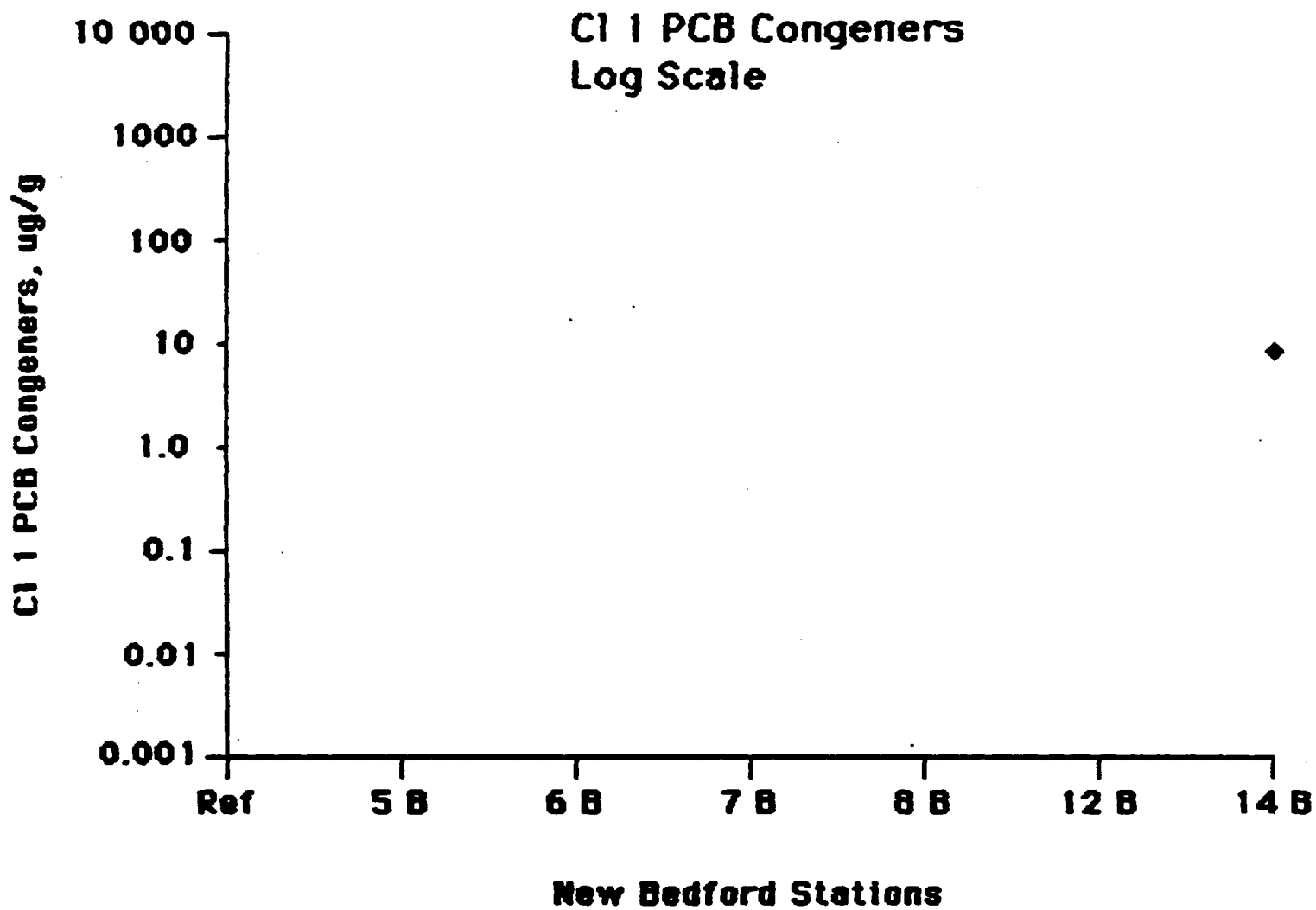


Figure 16

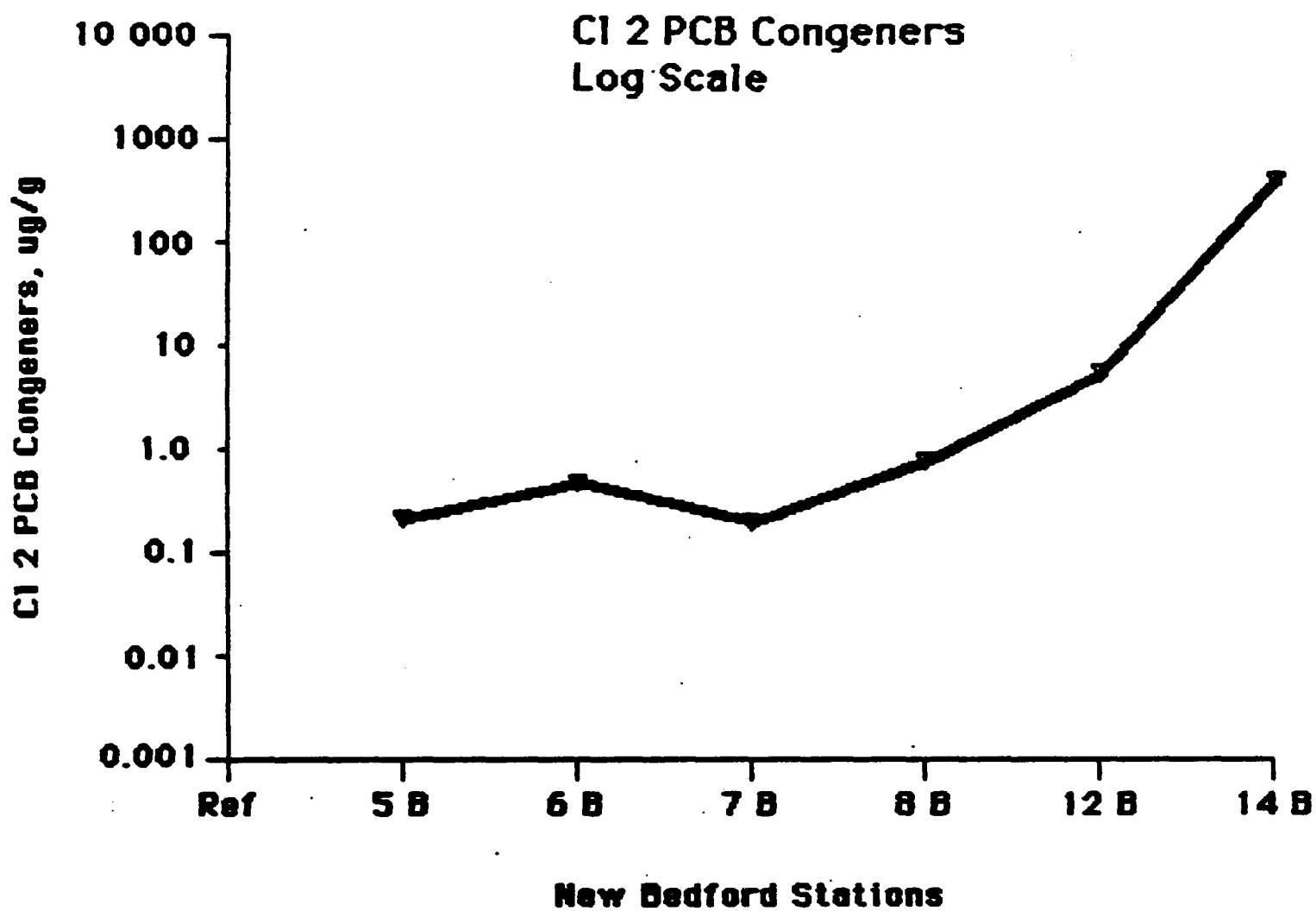


Figure 17

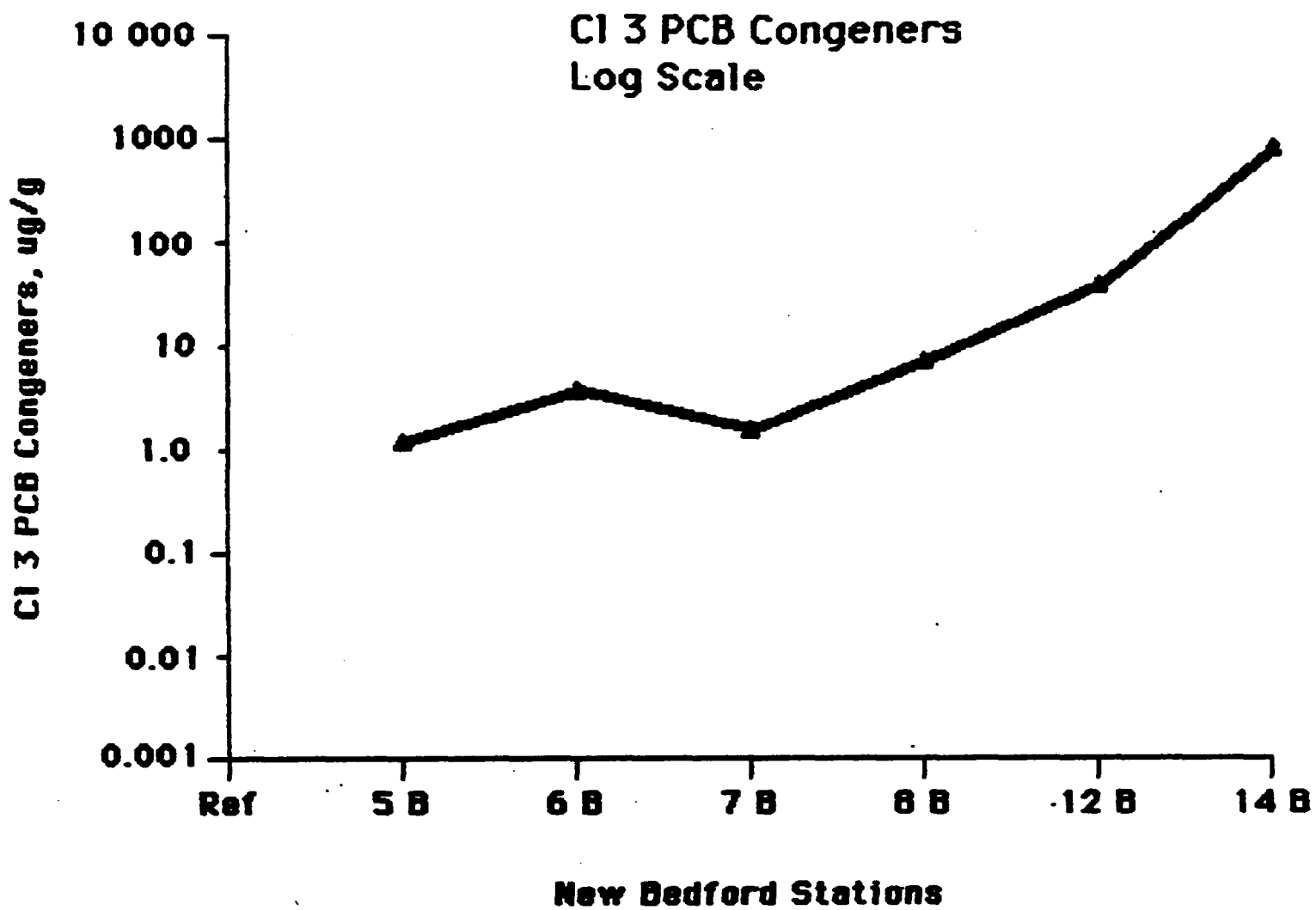


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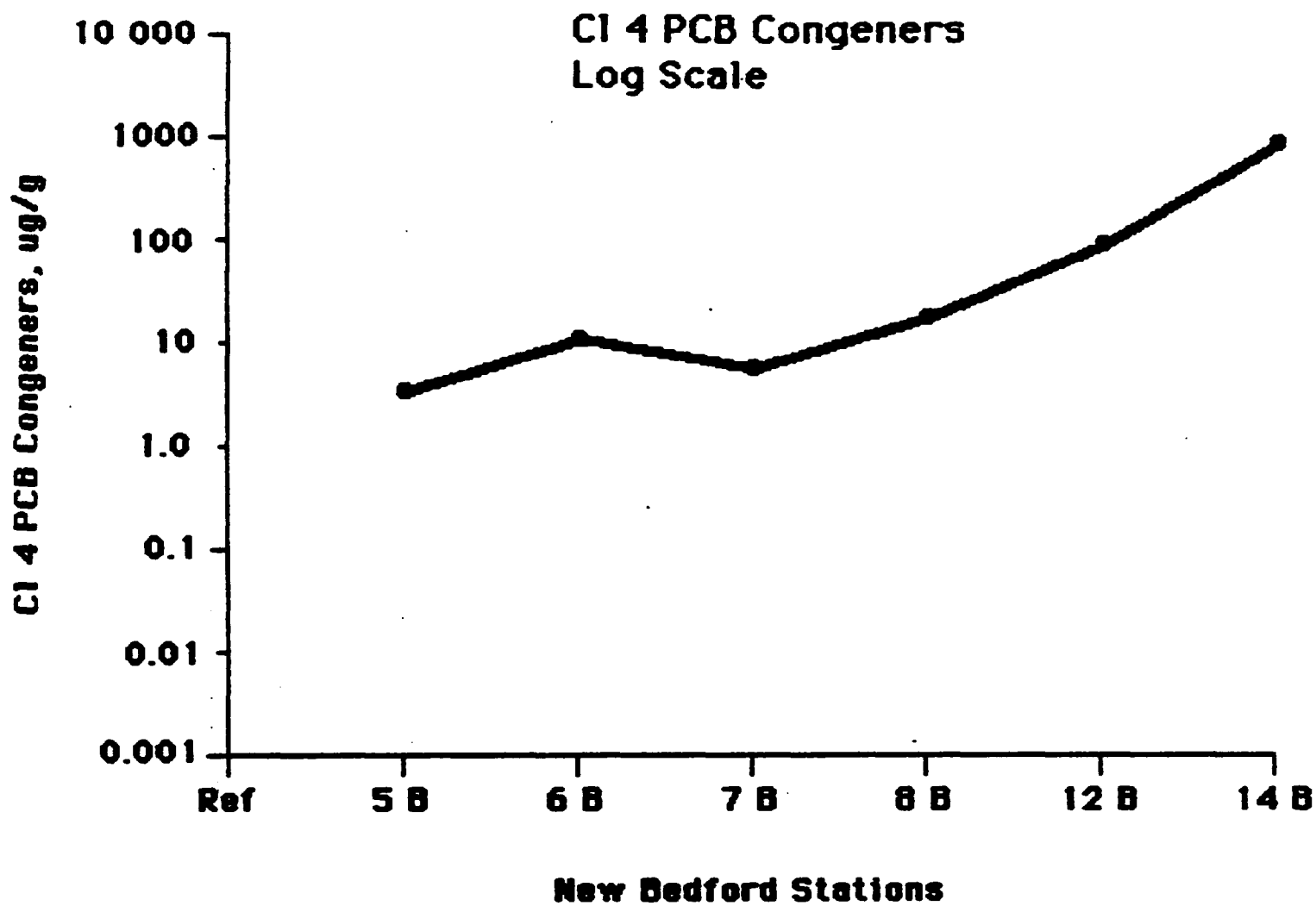


Figure 19

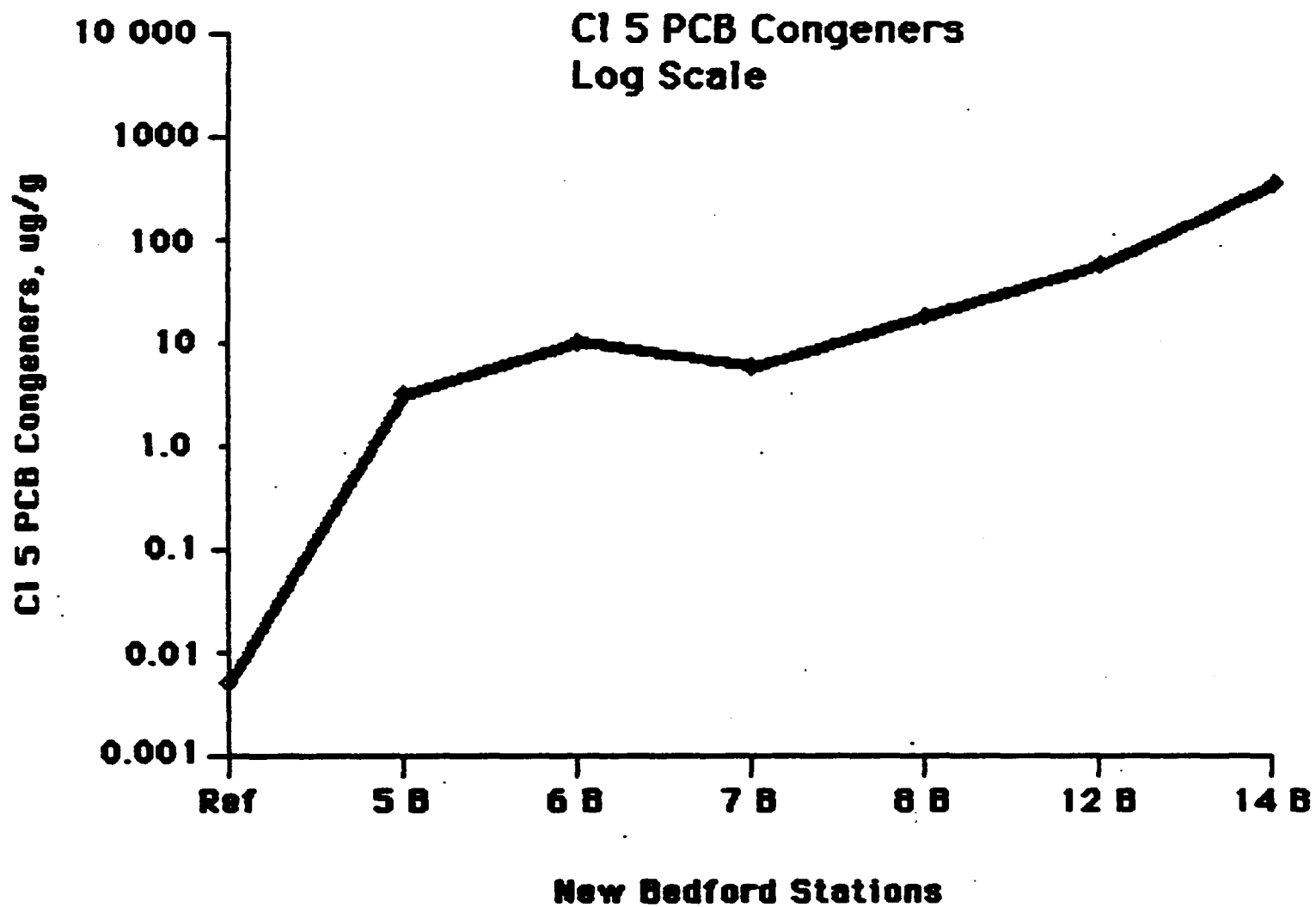


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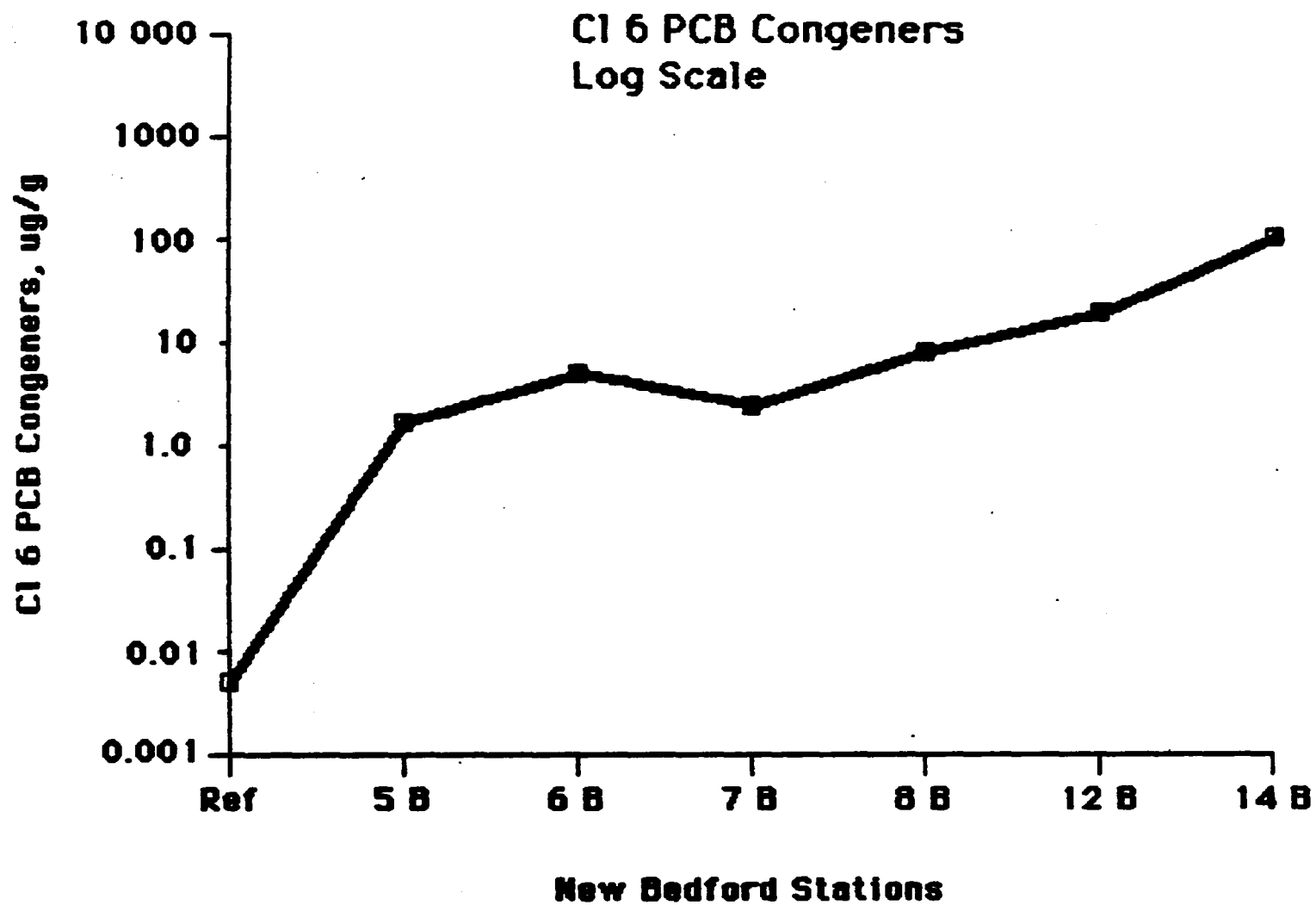


Figure 21

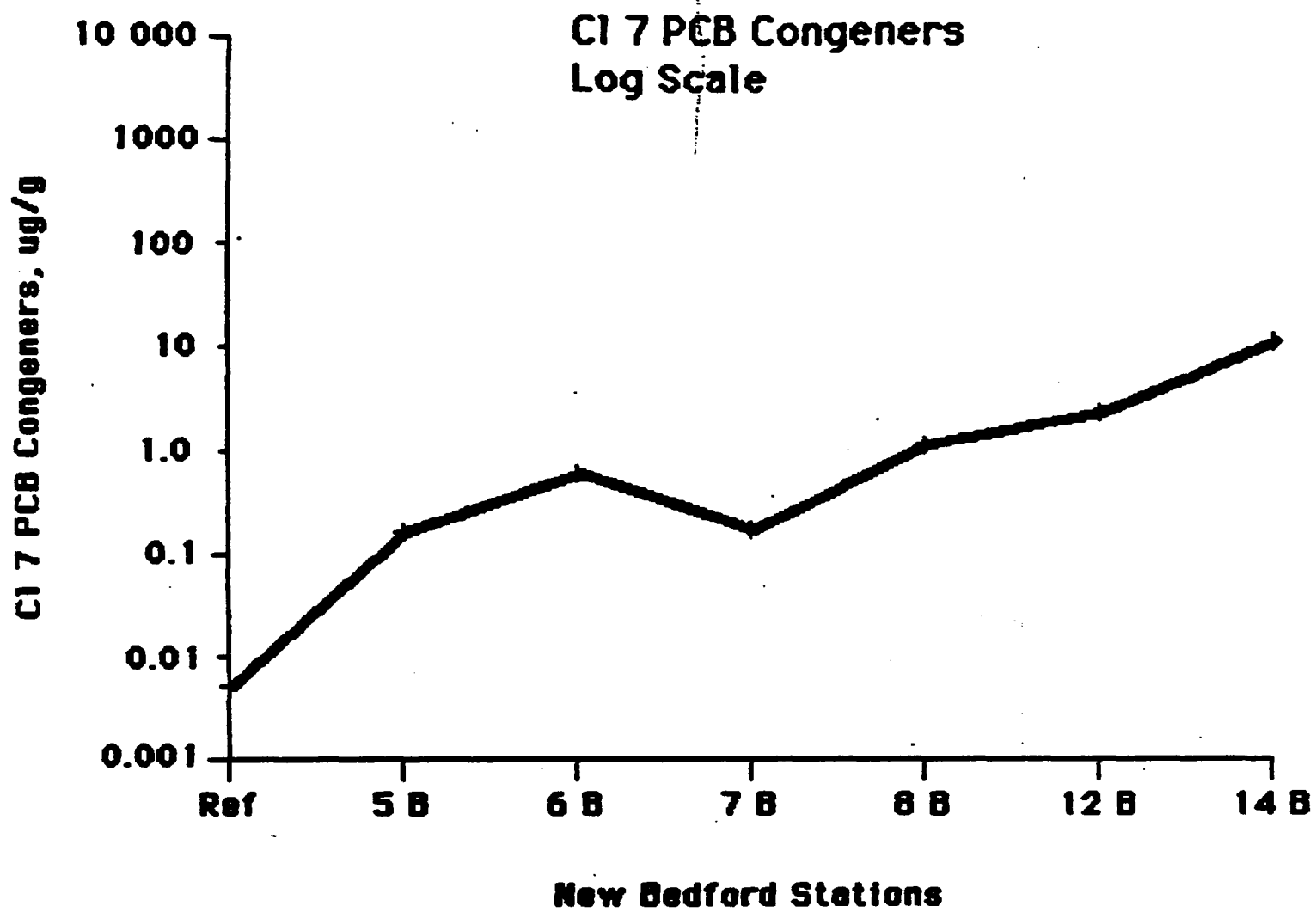
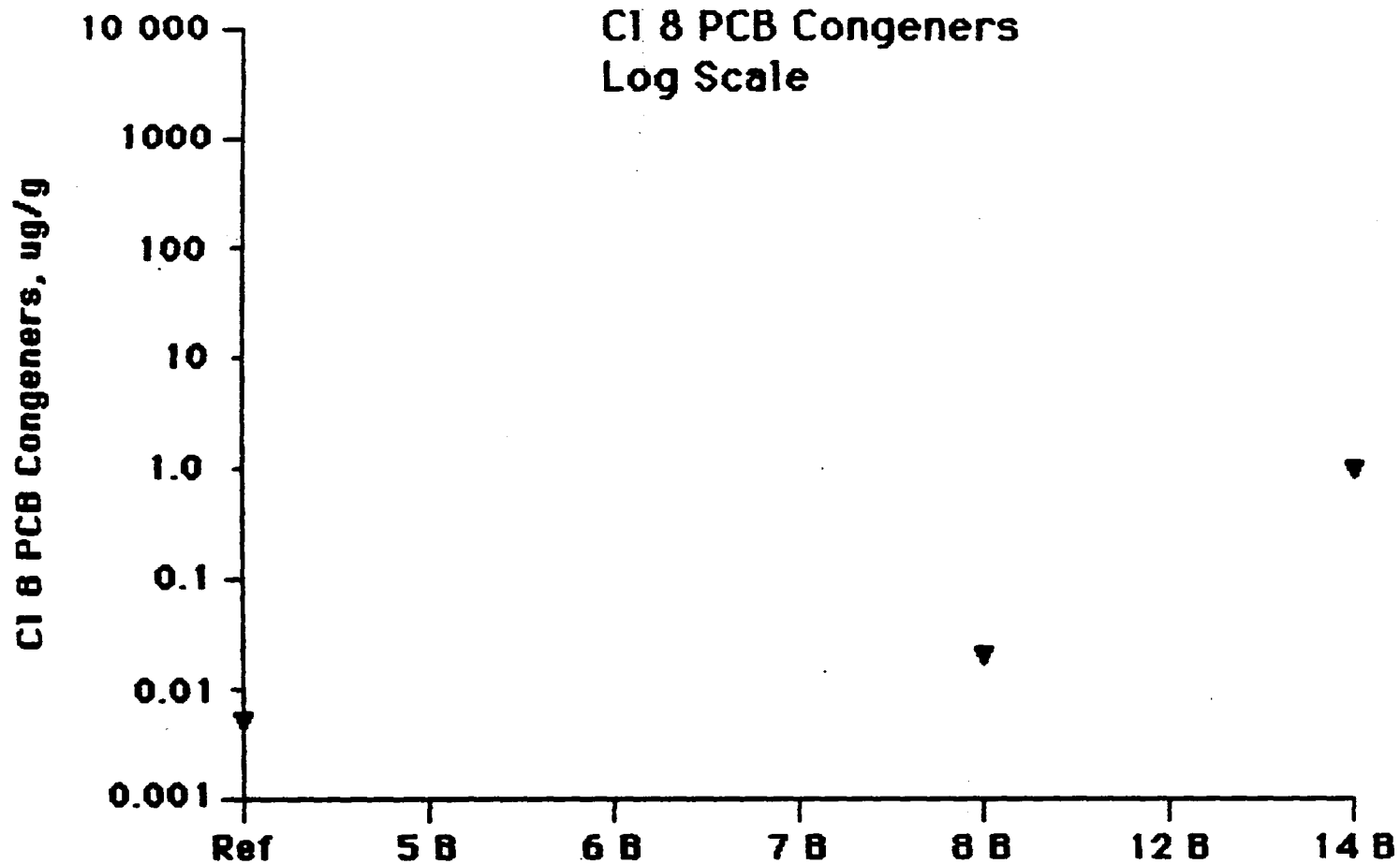


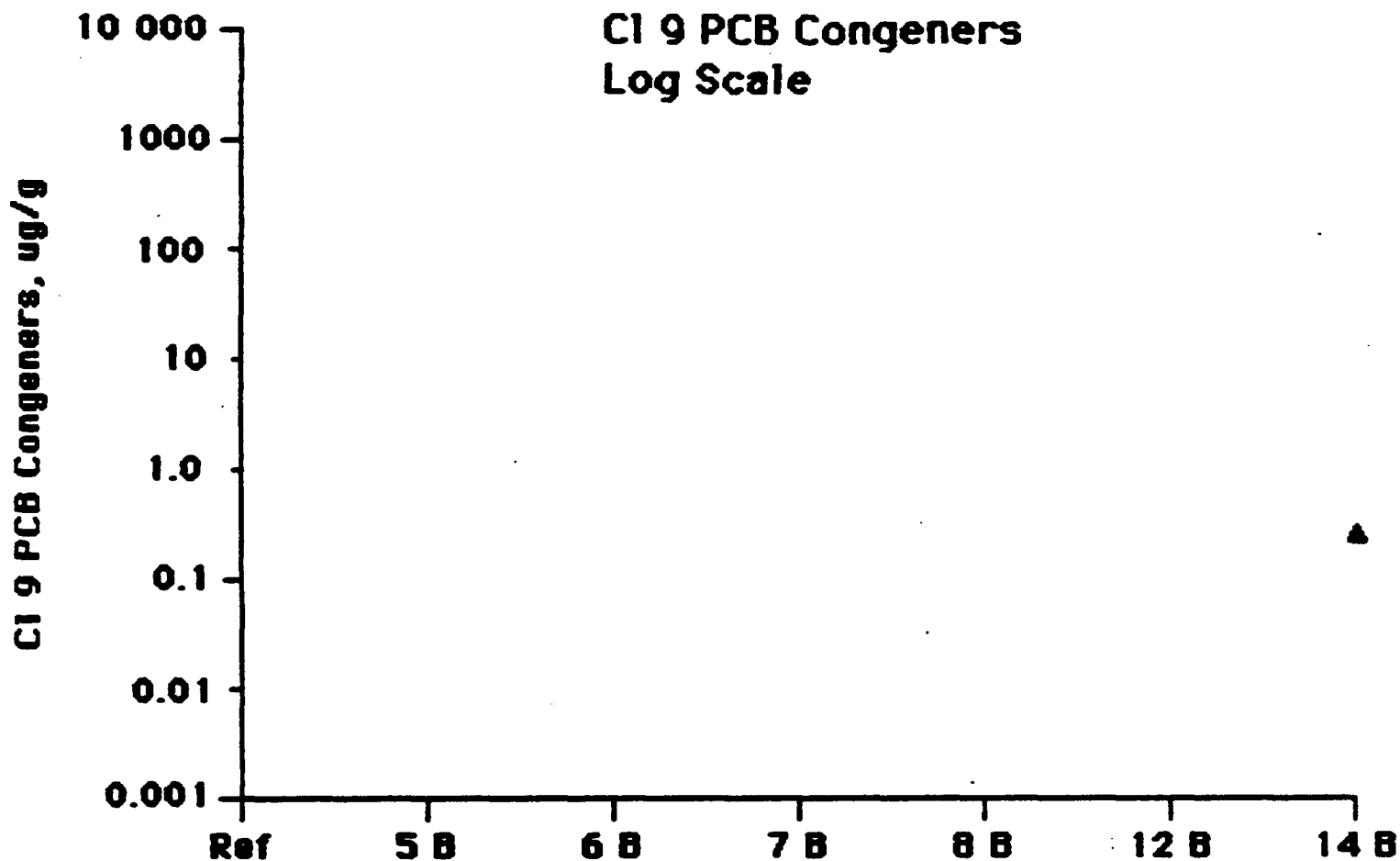
Figure 22

CI 8 PCB Congeners Log Scale



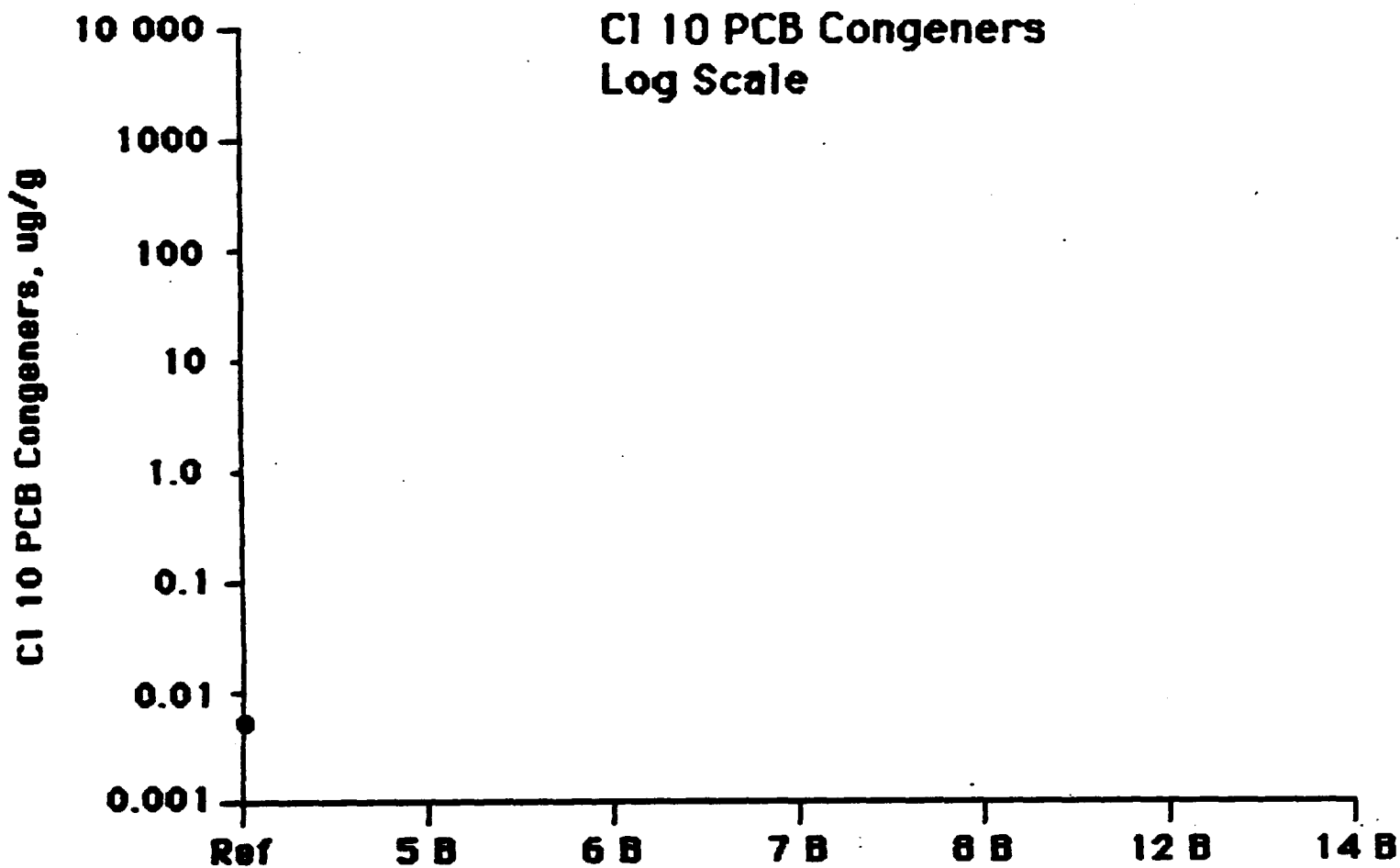
New Bedford Stations

Figure 23



New Bedford Stations

Figure 24



New Bedford Stations

Figure 25